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LASER AS A GOOD NON-DESTRUCTIVE TOOL FOR SELECTION OF RICE KERNEL COLOR

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ABSTRACT

The device based on concentrating a very thin beam of red laser with certain wave length either from: (1) upwards or downwards of the rice kernel (paddy) placed on a photoelectric cell which converts the emmitted "or the resulted halo of" light through or by the kernel into electric current which can be measured or (2) upwards or sidewards of the kernel placed on a special surface.

The white endosperm inside the kernel produces an electric current which is higher than that produced by red endosperm (or even any other color).

Making a very small window (hole) manually in the kernel hull, apart from the embryo, was utilized for checking the results with about 95% reliability (an application by the author for a patent N_ 24/1/1999).

This technique could enable rice breeders, for the first time, to utilize laser as an efficient method for selecting genotypes for one (up to the present) of the important quality characters for export.

The author, tried to extrapolate this technique to help selection for other characters in other crops, but the device should be modified to suit corresponding cases.

Keywords: ***Laser, Rice, Drought resistance, Mutants, Gamma rays, Screening method, Non-destructive dehulling.***

INTRODUCTION

Plant breeders, like other research workers in other branches, tried to make use of recent and new developed facilities available for evaluating what they investigate. For example, soil scientists utilized laser beams in leveling lands. They also utilized neutron moisture meter to detect moisture content of the soil (Abdalla *et al* 1997). The author and co-workers utilized during, the 1970s and 1980s, Nuclear Magnetic Resonance (NMR) which was a new facility at that time to measure or screen genotypes for seed oil content of some crops such as sesame, corn and flax as a non destructive screening method (Abo-Hegazi *et al* 1981). Infra red light also has been utilized in measuring and selecting nine seed characteristics by the ifralyzer. However, through specific information networks and internet, the author got no information that laser was or has been utilized by plant breeders and geneticists up to the present. For sotring out rice kernels based on endosperm color. Therefore, no references are available on this point.

The author (mutation breeder), got a number of drought resistant rice mutants (Abo-Hegazi 1995), which consume about one half of the irrigation water required by ordinary rice varieties and could be planted under drip, sprinkler or surface irrigation even in sandy and sandy loam (desert) soils. Two of these mutants (Hegazi A 20 W R and Hegazi Ahsa 20)

were characteirized with a high percentage of seeds of a red endosperm. I tried to reproduce such pure lines with red endosperm, but I need to know their genetic behavior or at least their endosperm color before planting and leaving the embryo viable. (without dehulling). Dehulling usually destroy the embryo. Several methods, therefore, has been tried by the author to know the colour of the endosperm without dehulling the rice kernel (paddy). Lastly the author succeeded to identify the colour of the hulled paddy by a laser beam.

The aim of the present investigation is to acquaint plant breeders and geneticists with the utilization of laser as a screening-non-destructive method for the colour of the endosperm of paddy kernels.

MATERIALS AND METHODS

A very narrow red laser beam with a certain wave length as well as photo-cells which converts the transmitted laser light or the hallow-light of the transmitted or reflected light to an electric current which could be measured were used. A special surface was utilized to place the seed on to obtain the halo after making the very thin beam of laser which illuminates the seed. This halo would also be converted into a measurable electric current by the photocell.

For comparisons, some rice (paddy) seeds were taken and a very small part of one side of the hull was manually removed (window). This window is usually located in the center of the seed, apart from the embryo.

The laser beam has been concentrated on the center of the seed (paddy) in both of the hulled seed as well as that which have a window in the hull.

The electric current generated by the photocell which is placed under or above the hulled seed, or even beside it when the special surface is utilized during concentrating the beam was measured.

Several hundreds of seeds with windows showing red endosperm, and others with white endroperm were tested by this technique. Errors in reading were put as percentages.

Then 100 of the hulled seeds were tested in each of five replications and then dehulled to determine the reliability of the method. Data recorded included percentage of error in readings. The author prefered to put the obtained data as percentages for the sake of simplicity, however, other statistical operations could be performed.

RESULTS AND DISCUSSION

Table (1): showed that the percentage of erroneous readings for the red endosperm ranged from 0% (replication I) to 7% (Repl. IV.). The total number of false or erroneous readings was 16 from a total of 500 readings with a percent 3.2% while the percentages of the erroneous readings for the

white endorperm ranged from 2% (Repl. II) to 20% (Repl. III). The total number of the false readings for white endosperm rice was 36 from a total of 500 readings with a percentage of 7.25. The percentage of the overall error of the experiment ranged from 0.015 to 0.11 with a general mean of 0.01. So, this method could be considered as a reliable method for screening rice genotypes for the color of the endosperm of the paddy kernel without dehulling which could help breeders and geneticists in their work.

Table 1. Number of expected and measured readings for the color of paddy kernel endosperm (white and red) in five replications

Replication	Red		White		Error	General error e/a+c
	Expected[a]	Measured[b]	Expected[c]	Measured[d]	No.[e]	
I	100	100	100	97	3	0.015
II	100	94	100	98	8	0.040
III	100	98	100	80	22	0.110
IV	100	93	100	95	12	0.060
V	100	99	100	94	5	0.025
Total	500	484	500	464	50	0.250
Mean of error	-	3.2%	-	7.2%	-	1.0%

Tran *et al* (2006) obtained several colours of rice seed ranging from red to white.

This technique could be considered efficient to reject red endosperm kernel of rice before shipment due to rules that consider them undesirable for markets regardless of their higher nutritional value than the ordinary white endosperm. This technique may be utilized in the future for other characters in other crops but after necessary modification in the device.

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الليزر كوسيلة غير إتلافيةلإنتخاب اللون فى حبوب الأرز

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تعتـــمد تلك الطريقـــــة على تركيز شعـــــاع رفيع جـــــــدا من الليزر الأحمر بطول موجى معين إما:

1-من أعلى أو من أسفل حبة (الأرز الشعير) التى توضع فوق خلية ضوئية تحول الضوء المار من الحبة أو الهالة الضوئية المنبعثة حولها إلى تيار كهربى يمكن قياسه.

2-من أعلى أو من جانب الحبة التى توضع على سطح خاص.

يحتوى الإندوسبيرم الأبيض بداخل الحبة تيار كهربى أشد من الذى يحتويه الإندوسبيرم الأحمر، تم عمل (ثقب) أو فتحة صغيرة فى قشرة الحبة بعيدا عن الجنين بطريقة يدوية تستخدم للمقارنة، وكانت مصداقية الطريقة 95% (طلب براءة اختراع رقم 1999/1/24 للمؤلف).

والتقنية المذكورة تمكن مربى الأرز لأول مرة من استخدام الليزر كوسيلة فعالة للانتخاب لصفة من أهم الصفات قبل شحن (تسويق) الأرز الشعير حيث يمكن أن ترفض الشحنات المحتوية على بذور أرز ذات إندوسبيرم أحمر بالرغم من أن تلك البذور أعلى فى قيمتها الغذائية من البيضاء، وكان الباحث قد حصل على ظفرات أرز ذات اندوسبيرم أحمر.

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